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ON THE CLASSIFICATION OF BEETLES ACCORDING TO LARVAL CHARACTERS.*

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The study of the immature stages of the beetles is still in a preparatory or pioneer state. Much has been written about the larvae; the older synoptic works by Erickson, Schiødte, Perris, and others are of the greatest value, and so are the papers of many contemporary entomologists from different countries; but no complete classification of the coleopterous larvae has been published. Nevertheless, it is unquestionable that the study of the larval stages has brought to light important facts bearing upon the discussion of the phylogeny of the families and their proper classification. Quoting from the impartial and weighty paper by Dr. C. J. Gahan in "The Entomologist," 1911:

> "Conclusions that may be drawn from a study of the external morphology of the imagines alone are sometimes apt to be upset, or at least not completely borne out by a study of the corresponding larval forms. Certainly it is sometimes very surprising to see what great differences there are between the larvae of certain families which otherwise would be considered to be very nearly related."

This assertion of Dr. Gahan I shall try to exemplify.

According to Leng's Catalogue of North American Coleoptera, 1920, the series Dryopoidea includes five families, namely, (1) the Psephenidae, (2) the Dryopidae with genera like *Lara, Parnus* and *Helichus,* (3) the Helmidae, (4) the Heteroceridae and (5) the Georyssidae; and according to the same catalogue the series Dascilloidea includes three families, namely, (1) the Dascillidae with the subfamilies Dascillinae, Eubriinae and Eucinetinae, (2) the Helodidae with Helodinae and Ptilodactylinae and (3) the Chelonariidae.

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Commenting on this classification, Dr. Leng writes (on p. 32) in the introduction to the Catalogue: "The series Dryopoidea seems to be naturally defined—its elements are not greatly disputed, but forms, like *Placonycha,* can only be placed with certainty by knowing the larvae," and on the next page: "Some genera now included in Dascillidae may have to be removed therefrom when the larvae are better known." The classification and the comments of this catalogue, certainly America's most valuable contribution of the present epoch to the taxonomy of Coleoptera, I propose to use as a sort of background for a brief review of the bearing that the characters of the larvae may have upon the phylogeny and taxonomy of the two series.

Some of these larvae, which have been little or not known in the past, not only evince as you will see a relationship to exist between the Dryopoidea and Dascilloidea, but they also suggest a systematic rearrangement of the forms in each series, and a potential shifting of genera from the one series to the other, as surmised by Leng. Moreover, we are confronted with the possibility that it is from types belonging to the Dryopoid-Dascilloid series that other series, particularly the Elateroidea and the Scaraboidea, may have departed. Finally the larva of *Eucinetus* indicates that this genus may have to be segregated from the Dryopoid-Dascilloid series and placed near the Derodontidae, or Cryptophagidae, or other Cucujoid families affiliated with these.

Lara (*avara* Le Conte?). (Plate I.)

On the accompanying plate the general appearance and the anatomical details are shown of a larva from Portland, Oregon. By elimination and according to locality it has been determined as *Lara avara* Leconte (?). (The correct determination is for our present purpose really of minor consideration, and for the sake of expediency I will risk the assumption that the determination is correct; the larva will from now on be referred to simply as the "*Lara* larva.")

The general appearance of the *Lara* larva is that of a typical *Parnus* or *Helmis* larva. The form of the legs, the development of the segments, the number and location of the spiracles are similar and the spiracles are bifore. The larvae furthermore concur in lacking a maxillary articulating area between the maxillae and submentum, a characteristic morphological reduction which is of great taxonomic importance. However, unlike the larvae of Parnids and Helmids, the *Lara* larva possesses six distinct ocelli on each side, and the mandible has two distal teeth and a short retinaculum. The flat ventral side of the tenth abdominal segment is continued into a flat, longitudinally bisected component part that carries a pair of long terminal hooks. With the underside of the prolonged tergal region of the ninth abdominal segment, this tenth abdominal segment forms a sort of cloacal chamber, but it has no operculum and there are no gills inside of the chamber.

Limnius troglodytes Gyllenhal and *Helichus* sp. (Plate II.)

In general shape the larva of *Limnius* looks much like *Lara*. The larva of *Helichus* is broader, flatter and shorter, has the head completely hidden below the prothoracic shield, the body segments laterally prolonged, the ninth abdominal segment only slightly longer than wide, and all the spiracles absent except on the eighth abdominal segment where they are located at the ends of the lateral prolongations. However, in all anatomical details of taxonomic importance *Helichus* and *Limnius* agree, and these details can therefore be described collectively.

In accordance with the development of the same anatomical features in the *Lara* larva, the larvae of *Limnius* and *Helichus* have elongate antennae, their mandibles have no molar part, the maxillae project into a distinct lacinia and a distinct free galea, ligula is broad, mentum and submentum broad.

Together they differ from *Lara* in the following cardinal points: there is only a single but large ocellus on each side, the mandible has a simple apex and vestigial or no retinaculum, and the ventral part of the tenth abdominal segment forms a movable lid or " operculum " that acts against and fits into a trough-shaped concavity in the underside of the tergal shield of the preceding segment. On top of the operculum (figs. M and N) is a soft pad with two minute spines which are homologous with the strong hooks of *Lara*. Both the pad and the spines are hidden in the cloacal chamber, and this contains in addition to the spines three well-developed tassel-like projectile or retractile gills.

Amphicyrta chrysomelina Erickson and other Byrrhid larvae. (Plate III.)

To explain the taxonomic position of the *Lara* and the Helmid-Dryopid larvae a brief discussion of some of the Byrrhid larvae is necessary.

Byrrhid larvae differ from the larvae of *Lara* and the Helmid-Dryopid by having a large maxillary articulating area (a figs. K and R) and this is in fact the only essential character by which they can be separated. To be sure, the development of the ninth and tenth abdominal segments in the Byrrhids conforms more with the normal development of these segments in beetle larvae in general than does that of *Lara* and the Dryopids. However, the tenth is unusually large in Byrrhids and the ventral portion below anus somewhat protrudes, and is in *Amphicyrta* divided into a proximal portion and a distal portion which terminates in a spine (fig. L). Thus the actual dissimilarity between these features in *Amphicyrta* and in *Lara* depends solely on a variation in degree and not in substance, the features are homologous. It is also true that no Byrrhid larva possesses a cloacal chamber even of the imperfect type in *Lara,* but neither is a cloacal chamber found in all larvae belonging to the Dryopoidea, as we shall see later on.

The Byrrhid larvae have, just as the *Lara* larva, six ocelli on each side and nine pair of lateral and bifore spiracles. In the larvae of *Amphicyrta* and *Lioon* the mandible (figs. T and Q) is distally multidentate, but in *Cytilus* (fig. A) and *Byrrhus* it is bidentate with a short retinaculum as in *Lara.* However, it should be noted that all Byrrhid larvae have a long series of hairs in the posterior part of the inner mandibular margin.

Taking one thing with another, the logic of the presented facts bears out that the Helmid-Dryopid larvae have developed from Byrrhoid ancestors, probably with *Lara*-like larvae as connecting links.

Byrrhus fasciatus Forster. (Plate IV.)

The setose posterior portion of the mandible (figs. B and E), just said to be characteristic for all true Byrrhid larvae, projects conspicuously in *Byrrhus fasciatus* and is markedly set off from the rest of the mandible. It suggests a rudimental molar part and confronts us with a morphological differentiation of importance for the understanding of the complicated mandibles which are found in the larvae of the genera *Heterocerus, Dascillus, Nosodendron,* and *Cyphon,* together with other Helodinae.

At the same time our attention is given to the changes in the form of the mandible, it is pertinent to mention that a corresponding transformation takes place in the hypopharyngeal region. For, while hypopharyngeal chitinizations are absent (figs. T and K) in all true Byrrhid larvae as well as in the *Lara* larva and the Dryopid-Helmid larvae like *Limnius* and *Helichus,* they are present and as a rule highly specialized in the four above-named larvae with complicated mandibles.

Psephenus lecontei Le Conte and *Eubrianax edwardsi* Le Conte.

(Plate V.)

In the discussion of the value of the cloacal chamber as a potential character to separate the larvae of the Dryopidae from the larvae of the Byrrhidae, I remarked that this organ does not occur in the larvae of all the genera which have been placed in the Dryopoid series and had in mind the larva of *Psephenus* and also the closely related larva of the genus *Eubrianax,* which customarily is placed in the series Dascilloidea.

The differences between the *Psephenus* larva and the *Eubrianax* larva are slight and immaterial from a taxonomic viewpoint; the two larvae can mainly be distinguished by the different form of their second thoracic tergite, by the existence or conversely the repression of the lateral prolongations from the eighth abdominal segment and by a small dissimilarity in the location of their spiracles.

Their coccid-like body is not very different from the body form of *Helichus* and almost identical with that of the larva of *Psephenoides,* another genus of the family Dryopidae.[1] Their antennae, mouthparts, the presence of a single large ocellus on each side, and the reduction of most of the spiracles are also characters which they have in common with the two Dryopid genera. However, by a further comparison of the taxonomic characters the following two fundamental differences are found between the larvae of the Psephenidae and the Dryopidae: In the first place the larvae of the Psephenidae (meaning the genera *Psephenus* and *Eubrianax*) possess below the first to fifth abdominal segments freely exposed gills which are absent in the Dryopidae; in the second place no terminal cloacal chamber with three feather-

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[1] See Adam G. Böving: The Immature Stages of *Psephenoides gahani* Champ. (Trans. Ent. Soc. London, vol. 74, 1926, pp. 381–388, plates 89 and 90.)

or tassel-like gills is found in the Psephenidae, but it always developed in the Dryopidae.

The usual taxonomic arrangement of the family Psephenidae close to the Dryopidae (including the Helmidae) is substantiated by their larvae, but this does not mean that the Psephenidae can be considered as directly outgrown from the Dryopidae. They are in most of the characters as close to the larvae of the genera *Anchytarsus, Ptilodactylus* and *Eurypogon* as they are to the Dryopidae, and in the two essential characters, namely, the presence of ventral gills and the absence of a cloacal chamber, they are hardly as far remote from these three genera as they are from the Dryopidae.[1a]

Ptilodactyla serricollis Say and *Anchytarsus bicolor* Melsheimer.
(Plate VI and Plate VII.)

The larvae of *Ptilodactyla* and *Anchytarsus* are similar in form, namely, elongate cylindrical with a large, thick and fleshy tenth abdominal segment protruding from below the ninth tergite; the spiracles are typically bifore and there are nine pairs present, all laterally located. Thus these larvae appear rather isomorphous with the *Byrrhus* larva.

However, unlike this larva, they have only one ocellus, or two, very close together, on each side; the mandibles are simple with a stylus-like prostheca but without a long series of hair from a rudimental molar part, and above all, a maxillary articulating area is absent. In all of these important characters the larvae of *Ptilodactyla* and *Anchytarsus* agree with the Dryopidae and with the Psephenidae.

The diagnostic characters that separate them from both the Byrrhidae and the Dryopidae and Psephenidae are rendered by special features on the tenth abdominal segment, namely, a pair of cleft diverticles whose inner lobes are either simple and hairy as in *Ptilodactyla* (fig. H, plate VI) or carry a bunch of finger-shaped gills as in *Anchytarsus* (fig. f, plate VII).

[1a] After the completion of the present paper the U. S. National Museum has received from Professor James G. Needham the very valuable gift of a larva taken by him in Hang-chow, China, which in the general shape and the details is near to the larva of *Eurypogon* but possesses like the Psephenidae larva ventral gills below most of the abdominal segments. A second larva of the same unknown genus has also been received through the courtesy of Dr. Hugh M. Smith from Nakon, Sutamaret, Siam. This larval form thus sustains the above expressed opinion that the Psephenidae are more closely related to the *Anchytarsus = Ptilodactyla = Eurypogon* group than to the Dryopidae.

The jugular skin of these larvae (fig. F, plate VI) can be distended and puffed up by blood pressure, a remarkable display which is not seen in other beetle larvae except in those of the Cebrionidae (including the former family Plastoceridae).[2] In *Ptilodactyla* there are behind the spiracles of the mesothorax and the eighth abdominal segment small, normally retractile sacs, which also can become turgid and extended; in *Anchytarsus* no similar organs are found.

Eurypogon niger Melsheimer. (Plate VIII.)

The genus *Euryopogon* is in our present system placed next to *Anchytarsus.* Certainly its larva is close to the larva of this genus, but not as close as the larva of *Ptilodactyla* is to the one of *Anchytarsus.* Principally there are no diverticles extending from the tenth segment, which is completely bare (fig. F, plate VIII). Besides, the clypeus is fused with frons, labrum is short, and the antennae and the mentum are somewhat different from those of *Anchytarsus* and *Ptilodactyla.* In all of these characters the larva of *Eurypogon* agrees with the larva of the *Cebrionidae.*

The larvae we have discussed so far have rather few characters in common with the larvae of the following genera, *Heterocerus, Dascillus,* all the Helodinae-genera, and *Nosodendron.* These constitute together a natural, but isolated group, that we shall come to presently, but first it will be expedient to consider the larva of the family Chelonariidae, customarily placed in the series Dascilloidae.

Chelonarium lecontei Thomson. (Plate IX.)

The larva of *Chelonarium lecontei,* reared and preserved in the U. S. National Museum, at the first sight appears as closely approaching the Dryopidae larvae. It looks like a plump *Helmis* or *Dryops* larva beset with spinose hairs of the same type as in the Dermestidae. There is only one large ocellus on each side, and the ninth and tenth abdominal segments form a cloacal chamber, with the ventral surface of the tenth shaped and acting as a well fitting operculum.

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[2] J. A. Hyslop: The present status of the Plastoceridae. (Proc. Ent. Soc. Wash., vol. 25, 1923, pp. 156–160, one plate.)

However, a careful examination of the anatomical details will show characters such as the presence of multidentate mandibles, maxillae with distinctly two-jointed galea, short antennae and a cloacal chamber with a pair of bilobed diverticles (fig. J) and an unpaired tripartite soft appendix, but no real gills, whereby the *Chelonarium* larva comes as near to the Byrrhoid stock as do the larvae of *Ptilodactyla* and *Anchytarsus.*

Finally a very remarkable and unique shape of its spiracles (figs. A, D and H) may establish a transitory form between the ordinary bifore spiracles found both in the Byrrhoids and most of the Dryopoids, and the cribriform spiracles typical for the larvae of *Heterocerus* and *Dascillus.*

The spiracles of *Chelonarium* are present in the normal number of nine pairs; they are moderately large and placed on the underside of projecting tubercles situated laterally on the mesothorax and the first seven abdominal segments, but dorsally and paramedianly on the eighth. Unquestionably they are bifore, but the airtubes are bent to each side, in a line, and with winding serpentine slits; the spiracular opening is small and circular.

Heterocerus ventralis Melsheimer. (Plate X.)

The larva of *Heterocerus* is allied to the *Lara* and *Chelonarium* larvae but also to the more common type of coleopterous larvae found in the Byrrhidae. It has five ocelli on each side, the tergite on the ninth abdominal segment is large but not excavated below, there is no operculum, and no cloacal chamber. Anus (fig. F) is located in the upper part of the tenth abdominal segment immediately below the ninth abdominal tergite and, as in *Amphicyrta,* the rest of the segment is prolonged into an unpaired, digitiform and two-jointed projection. This projection is rather large, capable of protrusion and retraction, and its terminal portion is completely softskinned, carrying neither a single spine as in *Amphicyrta* nor two hooks as in *Lara.* There are no branchial filaments. The antenna is short and the distal joint minute, but the apical tactile appendix is comparatively large and balloon-shaped. The prothoracic episterna (h p fig. K) are strong and triangular with projecting front angles overlapping the basal corners of the cranium.

The development both of the antennae and the episterna is unusual, but the characters or rather combination of characters by which this genus is segregated taxonomically from the larvae hitherto considered are the possession of cribriform spiracles, (fig. M), mandibles (figs. H and J) with a strong projecting molar part and a strong accessory ventral condyle fitting into a hypopharynx (hx fig. L) provided with a transverse chitinization against which the molar parts work.

Dascillus davidsoni LeConte. (Plate XI.)

The same combination of principal characters which distinguish the larva of *Heterocerus* is also found in *Dascillus,* but of course each character in the combination differs to a certain degree according to the different environmental and biological conditions to which the two larvae are subjected. Thus in *Dascillus* the mandibles have stronger molar parts (figs. E and F), the hypopharyngeal chitinizations (hc fig. I) are more differentiated and both the mandibles and the hypopharyngeal chitinizations are asymmetrical, the cribriform spiracles (fig. G) are larger and the pores in the spiracular plate more distinct and regularly arranged.

The general appearance of the two larvae is not particularly different and both have somewhat chitinized, not plicate tergites. The ninth abdominal tergite of *Dascillus* is similar to that of *Heterocerus* but the tenth is much smaller, almost rudimental, and without a terminal soft prolongation. Also in other details, but all of minor taxonomic importance, the *Dascillus* larva is distinguished from the *Heterocerus* larva: The labrum (fig. A) is short, clypeus large, fused with frons, both labrum and clypeus asymmetrical, antennae (fig. H) long, ocelli absent, a distinct maxillary articulating area (a fig. D) is present, both lacinia and galea long and slender, ligula different in size and form.

The larvae of *Heterocerus* and *Dascillus* are closely related taxonomically and both are decidedly different from all the larvae hitherto discussed, but, like these, derived from the Byrrhidae. The appearance of a rudimental molar part in the *Byrrhus* larva is particularly significant, as is the maxillary articulating area occurring both in the Byrrhids and *Dascillus.* The cribriform spiracles of *Heterocerus* and *Dascillus* may have developed through an intermediate spiracular type corresponding to the one found in *Chelonarium.*

Nosodendron californicus Horn and *Nosodendron unicolor* Say.
(Plate XXII.)

The affinities of *Nosodendron* have not yet been definitely established for the imaginal form of the genus. By some authors it has been placed near the Ostomidae and by others, for instance Leng in his Catalogue, as a subfamily of the Byrrhidae. Judging from the larva of *Nosodendron,* Leng is more nearly correct than the other authors, for there is hardly any connection between the *Nosodendron* larva and the Ostomid larva but unquestionably a rather close relationship between it and the Byrrhid larva. Thus the *Nosodendron* larva possesses six ocelli and a maxillary articulating area (a figs. G and O) just like the Byrrhid larva does. However, the *Heterocerus* larva has also six ocelli and both the *Heterocerus* and *Dascillus* larvae have a maxillary articulating area. Furthermore an inquiry into the finer anatomical details of the larva of *Nosodendron* reveals characters of fundamental taxonomic importance which are identical with the ones found in the *Heterocerus* and *Dascillus* larvae but not in the true Byrrhid larvae, namely, mandibles (fig. K) with a strong molar part and a strong accessory ventral condyle, and a hypopharynx (figs. P and Q) with conspicuous hypopharyngeal chitinizations. Therefore, according to the mentioned larvae, it is more consistent to place *Nosodendron* in the same series as *Heterocerus* and *Dascillus* rather than with the Byrrhidae.

This suggestion is supported by the presence in *Nosodendron* of characters not found in the Byrrhidae, and also to be sure not in *Heterocerus* or *Dascillus,* but in the larvae of the Helodinae which according to both imagines and larvae belong to the same series as *Dascillus.* These characters are: a broad ligula (li fig. O), a reduction almost to obliteration of the ninth and tenth abdominal segments (figs. A and I), and a location of a pair of large, well developed spiracles (figs. A and B) close together at the end of a particularly big and complete eighth abdominal segment that caps the end of the body. The other spiracles are also present and well developed but placed laterally in their tergites. All the spiracles are bifore and conform in this respect with the spiracles of the Byrrhidae and not with the cribriform spiracles of *Heterocerus* and *Dascillus.* In the Helodinae larvae the terminal spiracles are annualr and the other rudimental.

Prionocyphon discoideus Say. (Plate XIII.)

The larva of *Prionocyphon* which belongs to the Helodinae has, like the larvae of *Dascillus, Heterocerus* and *Nosodendron,* mandibles (fig. H) with a strong molar part and accessory ventral condyles (ac fig. H), and complete and well developed hypopharyngeal chitinizations (hc fig. F). Furthermore, it possesses a broad ligula, a large and terminal eighth abdominal segment (fig. E), very small, retractible and concealed ninth and tenth abdominal segments, and rudimental spiracles, except the eighth abdominal spiracles (8 Sp fig. D) which as mentioned are large and situated closely together below the end of the tergite to which they belong.

Other structures of interest, but of minor taxonomic importance, are the long, multiarticulate antennae (figs. B and E) which, however, according to Peyerimhoff[3] are organs of inconstant nature and apt to change into short, normally built antennae when the larvae are exposed to dry environments. There are five or six minute ocelli placed so closely together that they virtually are united into a single large eye on each side, and from the rudimental tenth segment, extending from above the anus, are three tassels of feather shaped gills (fig. C), which can be withdrawn into a pocket formed by the small terminal segments and situated inside of the eighth abdominal segment; but there is no cloacal chamber with a movable operculum as in the Dryopidae.

Eucinetus morio LeConte (?). (Plate XIV.)

The genus *Eucinetus* is according to the imagines placed as a subfamily of the Dascillidae, but judging from the larva the genus can not be placed with either the Dascilloidea or Dryopoidea. Unfortunately, the material on hand in the National Museum consists only of several cast larval skins, but the determination and probably also the rearing has been made by the very cautious and outstanding entomologist, the late Mr. H. G. Hubbard. Nevertheless, it should be emphasized that no definite record exists that imagines actually have been reared by him from the larval material preserved. Moreover, the old description and figures by Perris of *Eucinetus meridionalis* (Ann. Soc. Ent. France, series 2, vol. 9, 1851, pp. 48–53, pl. 2) do not agree with it. The association of the Hubbard larval material with the genus *Eucinetus* and the taxonomic discussion based on it should therefore be considered with proper reservation. The mandibles (figs. D and F) of this supposed *Eucinetus* larva have a molar part with a grinding surface of the type found in many Silphid larvae and also in many larvae of the Cucujoid type; the prostheca

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[3] P. De Peyerimhoff; Le double type larvaire de *Prionocyphon serricornis* Müll. Bull. Soc. Ent. France, 1913, pp. 148–151.)

is large, the distal part of the mandible is simple and narrow, the basal part broad. There are hypopharyngeal chitinizations (hx fig. H). The maxilla is very similar to that of *Derodontus* and has a mala only slightly divided (figs. B and G) into a low, soft, broad and indistinct galea and a pointed lacinia. The ninth and tenth abdominal segments (fig. E) are very simple, not different from the corresponding segments in many Cucujoid larvae, but entirely different from these segments in any of the Byrrhoid, Dryopid or Dascilloid larvae discussed.

In summarizing the taxonomic and phylogenetic results of our reasoning concerning the affinities of the genera which customarily have been placed in one of the two series Dascilloidea and Dryopoidea, we can now draw the conclusion that the larvae of these two series are derived from Byrrhoid ancestors. In common, the three series have the maxillary mala divided into a well defined lacinia and galea, and the galea is free, usually digitiform and often two-jointed. To be sure, these characters are not sufficent to separate them from the other series of beetle families, for instance from the Caraboidea, Staphylinoidea, Cucujoidea, etc. A diagnosis for this purpose, however, could readily be given, but to do so would be aside from our present plan.

The Byrrhoidea as here limited includes the subfamilies listed by Leng in the family Byrrhidae with exception of the Nosodendrinae. The larvae of the Byrrhoidea have a soft hypopharynx without chitinizations, a comparatively simple mandible without distinct molar part and with a long series of hairs at base, the maxillary articulating area is large, the spiracles bifore, the ocelli five or six on each side, and a cloacal chamber is absent.

The first of the two series derived from the Byrrhoidea includes the families Heteroceridae, Dascillidae, Nosodendridae and Helodidae. Of these families the Heteroceridae are according to the imagines listed in the Dryopoidea, the Nosodendridae in the Byrrhoidea and the Dascillidae and Helodidae in the Dascilloidea. Consequently the serial name "Dascilloidea" acquires a double meaning dependent upon whether we deal with larvae or imagines, but for the present it is deemed expedient to retain the old name.

In the series Dascilloidea the larvae possess a hypopharynx with distinct and strong chitinizations, the mandible has a large molar part, a maxillary articulating area is present. The families have either cribriform spiracles, all lateral, an eighth abdominal segment of normal form, and a large ninth abdominal segment, or, they have spiracles which are not cribriform, spiracles on the eighth abdominal segment which are terminal and close together, an eighth abdominal segment which is large and terminal and a rudimental ninth abdominal segment. The ocelli are, on each side six, one or none. A cloacal chamber with movable operculum is absent.

The second series derived from the Byrrhoidea includes five families, namely the Chelonariidae, Lariidae, Ptilodactylidae, Dryopidae and Psephenidae. Of these families the Chelodariidae have been listed according to the imagines in the Dascilloidea, the Lariidae in the Dryopoidea, the Ptilodactylidae in the Dascilloidea, the Dryopidae in the Drypopoidea, and one genus of the Psephenidae, namely *Psephenus,* in the Dryopoidea, another genus, *Eubrianax,* in the Dascilloidea. This series conforms no more than the former with the series named Dryopoidea in the classification of the imagines, but the old name will also be retained in the present case.

The larvae of the Dryopoidea have a hypopharynx without chitinizations, the mandible is simple, without molar part and without a long series of hairs at base, the maxillary articulating area is absent, the spiracles are bifore (exceptionally annular and then with most spiracles vestigial), there is only one ocellus on each side (except in *Lara* which has six ocelli), a cloacal chamber with movable operculum is present or absent.

Each of the five families of the Dryopoidea is characterized as follows:

The Chelonariidae have a very deviating type of bifore spiracles, the cloacal chamber is imperfect, no true gills, one ocellus.

The Lariidae have normal bifore spiracles, cloacal chamber imperfect, no gills, six ocelli.

The Ptilodactylidae, with three genera, *Ptilodactyla, Anchytarsus, Eurypogon,* formerly placed in the Dascilloidea, have bifore spiracles, no cloacal chamber, gills are present or absent, one ocellus.

The Dryopidae, with the genera *Pelonomus, Dryops, Helichus, Psephenoides, Stenelmis, Latelmis, Helmis, Limnius, Macronychus, Ancyronyx,* all placed formerly either in the Dryopidae or Helmidae, have bifore or annular spiracles, the cloacal chamber well developed, provided with operculum, gills present inside of the cloacal chamber, and one ocellus on each side.

The Psephenidae with *Psephenus* and *Eubrianax* (=*Placonycha*) have spiracles annular, cloacal chamber absent, gills present below first to fifth abdominal segments, one ocellus on each side.

The affinities existing between the *Eurypogon* larva and the larvae of the Cebrionidae have already been mentioned. There are Dryopoid characters also in the larvae of the Rhipiceridae and the Cardiophoridae, and it seems altogether plausible that the ancestors of the Elateridae are of Dryopoid stock. However, some phylogenetic connection may exist, some collateral derivation may be traced, between the Elateridae and the Ostomidae.

As a mere passing remark it may be indicated here that the larvae of the Cantharidae also have a double phylogenetic affiliation, namely with the Dryopoidea and the Melyridae.

The discovery of Verhoeff[4] that the larvae of the Lamellicornia have the essential systematic characters in common with the larva of *Dascillus,* is so well known that it only needs to be mentioned here. The isolation of the Lamellicornia, distinct in the imagines, is not apparent in the larvae and according to these the origin of the Lamellicornia from Dascilloid ancestors seems fairly definitely settled.

The Buprestidae are more logically derived directly from Byrrhoid-Dascilloid stock than indirectly through the Elateridae. The larva of *Rhaeboscelis,* discovered by Weiss and Nicolay and supposed (vide Leng's catalogue, p. 32) to be intermediate between the Elateridae and Buprestidae, is in every respect a true Buprestid larva.

The close affinities existing between the Byrrhoidea and the Cleroidea (including the Dermestidae, Melyridae, Cleridae and Ostomidae) have been discussed in Böving and Champlain's paper on North American Clerid larvae.[5]

It would be impossible in this address to give even a very brief account of the unpublished investigations made by my friend Dr. F. C. Craighead and myself of the bearing which the larvae have on the whole classification of the beetle families; but before I conclude I would like to present from this joint paper another example to prove the wisdom of Dr. Gahan's assertion that our final ideas about the classification of the Coleoptera will be influenced materially by the study of the larvae.

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[4] Beiträge zur Kenntnis der Coleopteren-Larven mit besonderer Berücksichtigung der Clavicornia von K. W. Verhoeff (Archiv. für Naturgeschichte, vol. 89, 1923, part A, pp. 48–63, figs. 72–86).

[5] In Proc. U. S. Nat. Mus., vol. 57, pp. 588–591, 1920.

We all know that the taxonomic positions of the Rhysodidae and the Cupedidae have been much discussed but without any final result. Lameere considered the Cupedidae as Adephaga of the most primitive type. Ganglbauer, de Peyerimhoff and d'Orchymont placed both the Rhysodidae and Cupedidae in the Adephaga. Kolbe (1908) placed the Rhysodidae in the Adephaga and included the Cupedidae as an isolated main division, named " Symphyogastra," in the suborder Polyphaga. Sharp and Muir placed the Rhysodidae in the Adephaga as a characteristic caraboid type and approximated the Cupedidae to the Byrrhoidea. Leng places with question mark the Rhysodidae as the first series of the Clavicornia, but adds, that he believes that the Rhysodidae is one of the nearly extinct branches of the primitive Coleoptera that originated while they still possessed characters now shared by the Adephaga; the Cupedidae he considers as modified survivors of an old polyphagous series and places them as a series, the Cupedoidea, close to the Lymexylonoidea. Imms in his "General Textbook of Entomology" (1924) follows Ganglbauer, de Peyerimhoff and d'Orchymont and considers both the Rhysodidae and the Cupedidae as separate families in the suborder Adephaga, so does Essig in " Insects of Western North America " (1926), and Tillyard in " Insects of Australia and New Zealand " (1926) raises the two groups to superfamily rank in the suborder Adephaga. Lastly Wm. T. M. Forbes in his paper on wing folding patterns of the Coleoptera (Journ. New York Ent. Soc., vol. 34, 1926) regards the Rhysodidae as a superfamily of Adephaga, the Rhysodoidea, and the Cupedidae and Micromalthidae as a suborder of Coleoptera, the Archostemata.

Clinidium sculptile Newman. (Plate XV.)

The larvae of the Adephaga are diagnosed by the following combination of characters: "Legs with tibia and tarsus separate, tarsus carrying one or two claws; labrum and clypeus fused together and with the frons to form a nasale; mandible without molar part; cardo small; hypopharynx without chitinizations; spiracles normally both present and annular." The larva of *Clinidium,* a genus of the Rhysodidae, agrees in full with this diagnosis and can without reservation be placed in the suborder Adephaga. However, it also possesses features which are particularly characteristic for it and definitely separate it from the larvae of all other adephagous families, namely, the presence of a prolonged epipharynx extending in front of nasale, partly retracted ventral mouthparts, maxilla with a rudimental lacinia only indicated by a long series of hairs and no galea, rudimental partly fused labial palpi, and a large spear-shaped gular plate. Combined, these characters define an adephagous series, the Rhysodoidea, that judging from their larvae is as distinct as the two other adephagous series, the Caraboidea and the Gyrinoidea, and constitutes a more typical adephagous series than the fourth series, the Paussoidea. The absence in *Clinidium* of ocelli and of urogomphi (= cerci auct.) is of slight taxonomic importance and are eliminations to be seen even in atypical larvae of the series Caraboidea.

Cupes concolor Westwood. (Plate XVI.)[6]

Cupes cannot be included in the suborder Adephaga according to the larva, nor does it ally with any of the Polyphaga, but it displays a combination of some characters only found in the larvae of the Adephaga, and some characters only found in the larvae of the Polyphaga. Thus the *Cupes* larva has legs with a separate tibia, tarsus, and claws, which is typical for all the Adephaga larvae. On the other hand, the *Cupes* larva has free labrum and clypeus, mandibles with a strong molar part, hypopharynx with heavy chitinizations, a large maxillary articulating area, a prominent and large lacinia and a free digitate galea, all characters which do not occur in the Adephaga but are present in many Polyphaga.

Features special for *Cupes* are a very projecting, broad and strongly chitinized ligula and an oval, cushioned lobe on each side of anus. The larva is blind, its body orthosomatic, fleshy, with dorsal and ventral ampullae, the tergum of ninth abdominal segment terminates with a conical, chitinized process, and the ninth sternum is small. All the spiracles are lateral and annular.

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[6] The larva of *Cupes concolor* described and figured first time, by T. E. Snyder (Proc. Ent. Soc. Wash., vol. XV, 1913, pp. 30–31, plate I.)

Micromalthus debilis LeConte. (Plate XVII.)[7]

The cerambycoid second and third stage larvae of *Micromalthus* possess all the diagnostic characters of *Cupes* except the taxonomically most important one, the mature *Micromalthus* larva being legless.

However, in the caraboid first larval stage *Micromalthus* possesses six-jointed legs each with distinct tibia, distinct tarsus and two claws. The tarsus moreover is much longer and slenderer than in *Cupes*. Both in the first stage larva and in the second and third stage larvae the end of the tergum of the ninth abdominal segment is prolonged, chitinized and bent down, and the ninth sternum is similarly prolonged but bent up so as to meet the tip of the tergum. In these stages the *Micromalthus* larva is very close to the *Cupes* larva; and together they form a group of very ancient and very specialized larval types. I can not see how we can escape giving to this group the rank of a suborder, the Archostemata Kolbe, as it can be joined neither with the Adephaga nor with the Polyphaga. It is noteworthy that Wm. T. M. Forbes in his above-mentioned important paper comes to the same conclusion from his investigation of the wing folding patterns of the imagines.

The larvae of the Lymexylonidae are nearer to the Archostemata larvae than to any other beetle larvae and may possibly have developed from a common ancestor.

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[7] H. S. Barber: Observations on the life history of *Micromalthus debilis* LeC. (Proc. Ent. Soc. Wash., vol. XV, 1913, pp. 31–38, plates II and III.)

H. S. Barber: The remarkable life history of a new family (Micromaltidae) of beetles. (Proc. Biol. Soc. Wash., vol. XXVI, 1913, pp. 185–190, plate IV.)

EXPLANATION OF PLATES[8]

PLATE I

Lara avara LeConte (?)

Fig. A. Dorsal view of larva.
Fig. B. Lateral view of larva.
Fig. C. Ventral view of larva.
Fig. D. Left maxilla, dorsal view.
Fig. E. Spiracle.
Fig. F. Right mandible.

PLATE II

Figs. A–E *Limnius troglodytes* Gyll.

Fig. A. Ventral view of larva.
Fig. B. Dorsal view of part of head.
Fig. C. Left mandible.
Fig. D. Right mandible—old and worn apically; lm, prostheca.
Fig. E. Ends of right maxilla and labium; ga, galea; lac, lacinia; li, ligula.

Figs. F–O *Helichus* sp.

Fig. F. Lateral view of larva.
Fig. G. Right mandible.
Fig. H. Dorsal view of larva.
Fig. I. Dorsal view of head.
Fig. J. Leg.
Fig. K. Ventral view of head; li, ligula, m, mentum; sm, submentum; ta, tentorium.
Fig. L. Ends of lacinia and galea viewed from buccal cavity.
Fig. M. Ventral view of end of abdomen, operculum removed.
Fig. N. Same as fig. M, with seventh abdominal segment and both operculum and tergum of ninth abdominal segment removed.
Fig. O. Ventral view of end of abdomen.

PLATE III

Figs. A–G *Cytilus alternatus* Say

Fig. A. Left mandible.

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[8] All figures drawn by Adam G. Böving with exception of the figures D, E, G, and J on plate VI and all the figures on plate VII and plate VIII, which have been made by J. A. Hyslop.

Fig. B. Right maxilla, ventral view; ca, cardo; mpf, maxillary palpifer.
Fig. C. Spiracle.
Fig. D. Antenna.
Fig. E. Labial palpi.
Fig. F. End of leg; ti, tibia.
Fig. G. Oblique ventral view of larva.

Figs. H–L *Amphicyrta chrysomelina* Erichson.

Fig. H. Lateral view of head.
Fig. I. Left mandible, ventral side.
Fig. J. Mouthparts viewed from the inside of the mouth; epx, epipharynx; hx, hypopharynx; ls, labium (= prementum); ma, maxilla; oe, oesophagus.
Fig. K. Ventral view of ventral mouthparts; a maxillary articulating area; g, gula; ls, labium (= prementum); m, mentum; sm, submentum.
Fig. L. Lateral view of ninth and tenth abdominal segments.

Figs. M–R *Lioon simplicipes* Mann.

Fig. M. Dorsal view of anterior portion of head.
Fig. N. Mouthparts viewed from the inside of the mouth; epx, epipharynx; hr, hypopharyngeal rod; hx, hypopharynx; li, ligula; lp, labial palpus; ls, labium (= prementum); m, mentum; sm, submentum; st, maxillary stipes.
Fig. O. Spiracle.
Fig. P. Lateral view of larva; mst, mesotergum; prt, protergum; sp, spiracle.
Fig. Q. Left mandible, ventral view.
Fig. R. Ventral view of ventral mouthparts; a, maxillary articulating area; gu, gula; ls, labium (= prementum); m, mentum; sm, submentum.

PLATE IV

Byrrhus fasciatus Forst.

Fig. A. Lateral view of larva.
Fig. B. Right mandible, ventral side.
Fig. C. Inner view of anterior part of head.
Fig. D. Antenna.
Fig. E. Right mandible, dorsal side.

Fig. F. Ventral view of ventral mouthparts; a, maxillary articulating area; gu, gula; li, ligula; ls, labium (= prementum); m, mentum; sm, submentum; tb, tentorial bridge.
Fig. G. Dorsal view of head.
Fig. H. Innerside of head with ventral mouthparts in dorsal view; ecr, epicranium; hb, hypopharyngeal transverse bracon; nc, superior ganglion of head; tb, tentorial bridge.
Fig. I. Lateral view of part of head from the outside; ecr, epicranium; hb, hypopharyngeal transverse bracon; hr, hypopharyngeal rod; hx, hypopharynx; li, ligula; lp, labial palp; m, mala (= lacinia and galea); mxp, maxillary palpiger; oe, oesophagus; st, maxillary stipes.
Fig. J. Left maxilla in dorsal view.
Fig. K. Lateral view of part of head from the outside, same as fig. I, but with maxilla removed; gu, gula; m, mentum; nc, superior ganglion of head; sm, submentum.
Fig. L. Left maxilla in ventral view; a, maxillary articulating area; ga, galea; la, lacinia.

PLATE V.

Figs. A–F *Eubrianax edwardsi* Lec.

Fig. A. Dorsal view of larva.
Fig. B. Right maxilla, ventral view; c, cardo; ga, galea; lac, lacinia; st, maxillary stipes.
Fig. C. Ventral view of part of head; c, cardo; lab, labrum; li, ligula; ls, labium (= prementum); m, mentum; ma, mala; st, maxillary stipes.
Fig. D. Left mandible, ventral view.
Fig. E. Left mandible, dorsal view.
Fig. F. Ventral view of larva.

Figs. G–O *Psephenus lecontei* LeC.

Fig. G. Ventral view of head; li, ligula; ls, labium (= prementum); m, mentum; sm, submentum.
Fig. H. Dorsal view of head.
Fig. I. Epipharynx; epr, epipharyngeal rod; o, eye from inside.
Fig. J. Maxilla and bottom of mouth cavity; li, ligula; pgn, paragnaths (= maxillulae).

Fig. K. Right maxilla.
Fig. L. Dorsal view of larva.
Fig. M. Left mandible, dorsal view.
Fig. N. Left mandible, ventral view.
Fig. O. Ventral view of larva.

Plate VI

Ptilodactyla serricollis Say

Fig. A. Dorsal view of head.
Fig. B. Ventral view of head; c, cardo; gs, gular suture; ls, labium (=prementum); m, mentum; sm, submentum; st, maxillary stipes.
Fig. C. Right mandible, dorsal view.
Fig. D. Right maxilla, dorsal view.
Fig. E. Right maxilla, ventral view.
Fig. F. Lateral view of anterior part of larva.
Fig. G. Spiracle.
Fig. H. Tenth abdominal segment, dorsal view.
Fig. I. Lateral view of larva.
Fig. J. Ninth abdominal segment, dorsal view.

Plate VII

Anchytarsus bicolor Melsh.

Fig. A. Lateral view of head.
Fig. B. Front view of head.
Fig. C. Ventral view of head.
Fig. D. Lateral view of end of abdomen.
Fig. E. Spiracle.
Fig. F. Dorsal view of larva.
Fig. G. Leg.
Fig. H. End of abdomen, ventral view.

Plate VIII

Eurypogon niger Melsh.

Fig. A. Antenna.
Fig. B. Lateral view of head.
Fig. C. Mandibles.
Fig. D. Ventral view of head.
Fig. E. Dorsal view of head.
Fig. F. End of abdomen, lateral view.
Fig. G. Dorsal view of larva.
Fig. H. Spiracle.

Plate IX

Figs. A–T *Chelonarium* sp.

Fig. A. Spiracle of mesothorax.
Fig. B. Dorsal view of anterior part of head.
Fig. C. Left mandible.
Fig. D. Spiracle of second abdominal segment.
Fig. E. Spiracular trachea and spiracle, from inside.
Fig. F. Ventral view of ventral mouthparts.
Fig. G. Lateral view of larva.
Fig. H. Spiracle of eighth abdominal segment.
Fig. I. End of ninth abdominal segment, dorsal view.
Fig. J. Tenth abdominal segment, operculum with appendices on dorsal side.

Figs. K–N *Ancyronyx variegatus* Germar (?)

Fig. K. Lateral view of larva.
Fig. L. Spiracles of mesothorax and of first abdominal segment.
Fig. M. Lateral view of head.
Fig. N. Leg.
Fig. O. *Helmis pusilla* LeC. Dorsal view of larva.
Fig. P. *Helmis aeneus* Müller. Dorsal view of larva.
Fig. Q. *Dryops auriculatus* Geoffr. Lateral view of larva.

Plate X.

Heterocerus ventralis Melsh.

Fig. A. Lateral view of larva.
Fig. B. Dorsal view of head.
Fig. C. Dorsal view of larva.
Fig. D. Antenna.
Fig. E. Epipharynx.
Fig. F. Tenth abdominal segment. Sagittal section to show anus and muscle inside of appendix.
Fig. G. Lateral view of anterior part of larva; hp, episternum of prothorax.
Fig. H. Left mandible, ventral view.
Fig. I. Left mandible, oblique dorsal view.
Fig. J. Ventral view of anterior part of larva; c, cardo; est, eusternum of prothorax; gu, gula; hp, episternum of prothorax; m, mentum; sm, submentum; stl, sternellum.

Fig. K. Ventral mouthparts, viewed from the buccal cavity; c, cardo; ga, galea; h, hypopharynx; lac, lacinia; st, maxillary stipes.
Fig. L. Tip of lacinia.
Fig. M. Spiracle.

PLATE XI

Dascillus davidsoni LeC.

Fig. A. Dorsal view of head.
Fig. B. Dorsal view of tergite of ninth abdominal segment.
Fig. C. Trochanter from below.
Fig. D. Ventral view of ventral side of head; a, maxillary articulating area; ca, cardo; gu, gula; hp, hypopleurum (= episternum and epimerum); li, ligula; ls, labium (= prementum); m, mentum; sm, submentum; st, maxillary stipes.
Fig. E. Left mandible, buccal face.
Fig. F. Left mandible, ventral view; ac, accessory ventral condyle.
Fig. G. Spiracle.
Fig. H. Lateral view of larva.
Fig. I. Head of larva, pulled to pieces to show mouthparts; ant, antenna; ca, cardo; epx, epipharynx with its chitinizations; hc, hypopharyngeal chitinizations; hp, hypopleurum; hx, hypopharynx; lab, labrum; li, ligula; lp, labial palpi; ls, labium (= prementum); m, mentum; ma, mala; md, mandible; pan, hypopharyngeal transverse bracon; sm, submentum; st, maxillary stipes.

PLATE XII

Figs. A–E *Nosodendron californicum* Horn

Fig. A. Dorsal view of eighth abdominal segment.
Fig. B. Spiracles of eighth abdominal segment.
Fig. C. Spiracle of second abdominal segment.
Fig. D. Lateral view of anterior part of larva (notice position of spiracle as compared with Fig. I.)
Fig. E. Ventral view of end of abdomen.

Figs. F–Q *Nosodendron unicolor* Say

Fig. F. Ventral view of right mandible.
Fig. G. Ventral view of right maxilla; a, maxillary articulating area; ga, galea; lac, lacinia.

Fig. H. Base of mandible from below.
Fig. I. Dorsal view of larva.
Fig. J. Ventral view of anterior part of larva.
Fig. K. Ventral view of right mandible and epipharynx.
Fig. L. Hypopharynx and ligula, lateral view; hb, hypopharyngeal bracon; hc, hypopharyngeal transverse chitinizations; hx, hypopharyngeal soft part; li, ligula; oe, oesophagus; pgn, paragnath (= maxillula).
Fig. M. Hypopharynx and ligula (legend as in figure N).
Fig. N. Right mandible, dorsal view.
Fig. O. Ventral mouthparts, ventral view; a, maxillary articulating area; c, cardo; ga, galea; lac, lacinia; li, ligula; ls, labium (= prementum); m, mentum; sm, submentum; st, stipes; ta, tentorium.
Fig. P. Innerside of hypopharyngeal chitinizations.
Fig. Q. Dorsal view of part of head.

Plate XIII

Prionocyphon discoideus Say

Fig. A. End of abdomen, ventral view.
Fig. B. Lateral view of larva.
Fig. C. Tassels of gills.
Fig. D. End of abdomen, lateral view, diagram; ac, alimentary canal; 8 sp, spiracle of eighth abdominal segment.
Fig. E. Dorsal view of larva.
Fig. F. Innerside of mouth; ga, galea; hb, hypopharyngeal transverse bracon; hc, hypopharyngeal chitinizations; hx, hypopharyngeal soft part; la, lacinia; li, ligula; pgn, paragnaths (= maxillulae).
Fig. G. Ventral mouthparts, ventral view.
Fig. H. Mandible and epipharynx; ac, accessory ventral condyle.

Plate XIV

(*Eucinetus morio* LeC.?)

Fig. A. Dorsal view of head.
Fig. B. Ventral view of head; a, maxillary articulating area; c, cardo; li, ligula; m, mentum; sm, submentum; st, stipes.
Fig. C. Lateral view of head.
Fig. D. Right mandible, ventral view; ac, accessory ventral condyle; mo, molar part; vc, ventral condyle.

Fig. E. Lateral view of body of larva, cast skin.

Fig. F. Ventral view of left mandible; ac, accessory ventral condyle.

Fig. G. Tip of lacinia and galea.

Fig. H. Hypopharynx; hb, hypopharyngeal bracon; hx, hypopharyngeal chitinization; pgn, paragnaths (= maxillulae).

PLATE XV

Clinidium sculptile Newm.

Fig. A. Dorsal view of head; epx, protruding epipharynx.

Fig. B. Right mandible, ventral view.

Fig. C. Right mandible, dorsal view.

Fig. D. Ventral side of head; a, maxillary articulating area with a sclerite; am, basal membrane of antenna; c, cardo; gu, gular plate; hy, hypostoma; li, ligula; ls, labium (= prementum); m, mentum; pst, presternum of prothorax; st, stipes maxillae; tp, tentorial pit.

Fig. E. Lateral view of larva.

Fig. F. Ventral mouthparts, dorsal view; a, maxillary articulating area; c, cardo; ecr, epicranium; laci, lacinia indicated by a row of hairs; li, ligula fused with rudimental labial palpi; md, socket for mandible; oe, oesophagus; st, stipes; ta, tentorial arm; tp, tentorial pit.

Fig. G. Dorsal view of part of abdominal tergum.

Fig. H. Leg; c, coxa; cl, claw; fe, femur; hp, hypopleurum (= episternum and epimerum); t, tarsus; tr, trochanter.

Fig. I. Ventral view of anterior part of larva; post, poststernellum; pst 1, presternum of prothorax; pst 2, presternum of mesothorax.

Fig. J. Spiracle.

PLATE XVI

Cupes concolor Westw.

Fig. A. Dorsal view of head.

Fig. B. Mandible with strong molar part.

Fig. C. Dorsal view of lower part of head with mouthparts.

Fig. D. Spiracle.

Fig. E. Lateral view of larva.

Fig. F. Ventral view of end of abdomen; stern 8, sternum of eighth abdominal segment.
Fig. G. Ventral view of anterior part of larva; cl, claw; f, femur; ta, tarsus; ti, tibia.

PLATE XVII

Micromalthus debilis LeC.

Figs. A–H Cerambycoid, legless second stage larva.
Fig. A. Dorsal view of head.
Fig. B. Ventral view of right maxilla; a, maxillary articulating area; c, cardo; ga, galea; lac, lacinia; mpf, maxillary palpifer.
Fig. C. Ventral view of head; hb, hypopharyngeal bracon; li, ligula.
Fig. D. Right mandible; mo, molar part.
Fig. E. Hypopharynx and ligula in dorsal view; hb, hypopharyngeal bracon; hx, hypopharyngeal chitinization; li, ligula.
Fig. F. Hypopharynx and labium, lateral view.
Fig. G. Lateral view of legless, second larva; ur, urogomphus (=cerci auct).
Fig. H. Ventral view of end of abdomen.
Fig. I. Spiracle.
Fig. J. Caraboid, legged first stage larva.
Leg; cl, claw; ta, tarsus; ti, tibia.